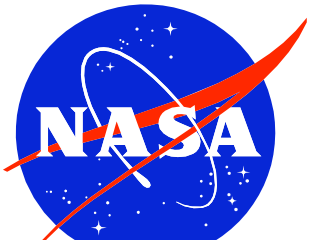
GSSC-0001

GAMMA-RAY LARGE AREA SPACE TELESCOPE (GLAST)

GLAST SCIENCE SUPPORT CENTER DEVELOPMENT PLAN

July 6, 2004



GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

GAMMA-RAY LARGE AREA SPACE TELESCOPE
(GLAST)

GLAST SCIENCE SUPPORT CENTER DEVELOPMENT PLAN

July 6, 2004

NASA Goddard Space Flight Center

Greenbelt, Maryland

7/8/2004

DOCUMENT APPROVAL

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7/8/2004

REVISION STATUS

This document is controlled by the GSSC internal document configuration management.

Version	Date	Pages Affected	Description
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Table of Contents

1 Introduction

1.1 Purpose

This development plan defines the approach and methodology for the development of the GLAST Science Support Center (GSSC) and its associated interfaces with the other elements of the GLAST Ground System.

1.2 Scope

This document covers the approach to developing the GSSC and its testing, documentation, maintenance and control. Design or operations concepts are not addressed. Where applicable information is covered elsewhere, reference is made to the relevant document.

1.3 Applicable Documents

The following documents contain information relevant to this plan:

- "GLAST Project Mission Operations Concept Document," 433-OPS-0001
- "GLAST Project Ground System Requirements Document," 433-RQMT-0006
- "GLAST Project Data Management Plan," 433-PLAN-0009
- "GLAST Science Support Center Functional Requirements Document," 433-RQMT-0002
- "GLAST Ground System Implementation Plan"
- "GSSC Verification Matrix," GSSC-0002
- "GSSC Design Document," GSSC-0003
- "GSSC Software Management Plan," GSSC-0004
- "GSSC Test Plan," GSSC-0005
- "Science Data Products Interface Control Document"
- "Operations Data Products Interface Control Document"
- "HEASARC-GSSC Memorandum of Understanding"

2 Organization and Responsibilities

2.1 Project Organization

The GLAST project is managed by the Goddard Space Flight Center (GSFC), Greenbelt, MD. The GLAST Project Office has overall project management responsibility to develop, deliver, and operate the GLAST mission. The GLAST Project Scientist is Dr. Steve Ritz of GSFC, who has the overall responsibility for meeting the mission's science objectives. The GLAST Project Manager is Kevin Grady of GSFC. The Project Office includes spacecraft and instrument management, systems engineering management, and Ground Systems management. The teams developing the two instruments have a major role in designing, developing and operating the mission. Peter Michelson (Stanford) is the PI of the primary instrument, the Large Area Telescope (LAT), while Chip Meegan (National Space Science and Technology Center in Huntsville, Alabama) is the PI of the gamma-ray burst instrument, the GLAST Burst Monitor (GBM). The GLAST Ground System is managed by the Ground System/Operations Manager (GSOM), Ken Lehtonen of GSFC. Figure 2-1 shows the structure and organization of the Ground System; see the "GLAST Ground System Project Plan" for more information.

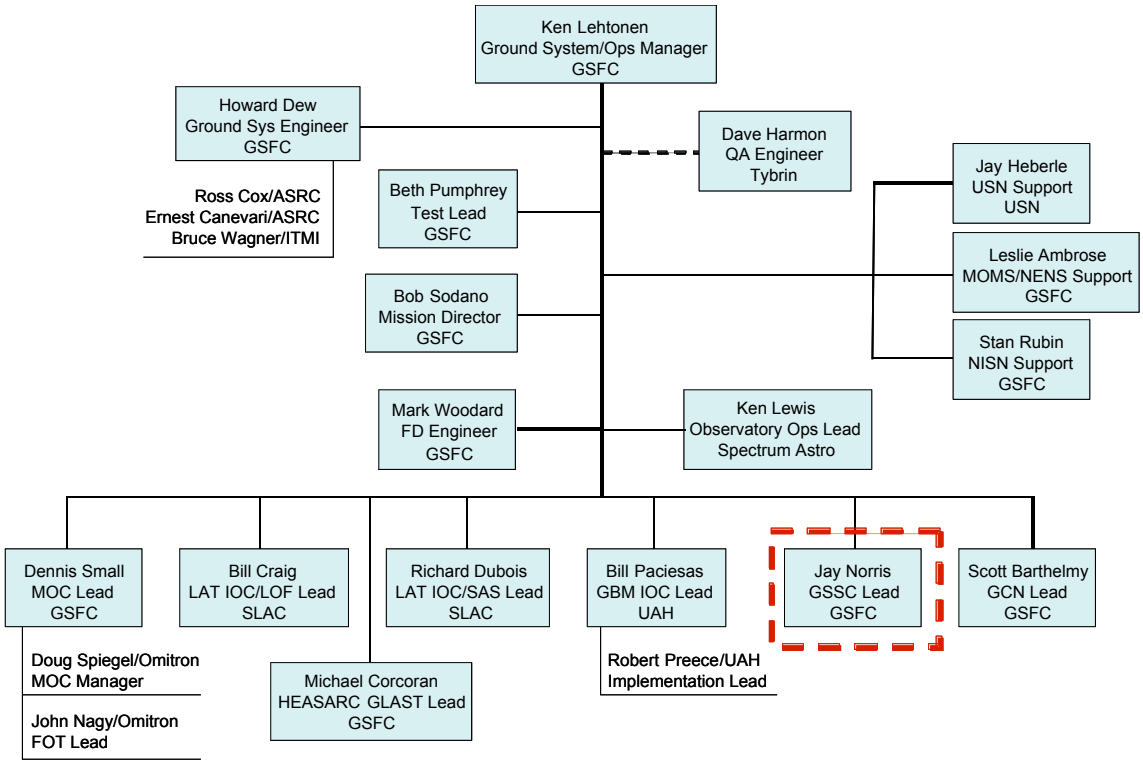

Figure 2-1—GLAST Ground System organization, with the GSSC indicated.

2.2 GSSC Development Organization

The GSSC staff is responsible for the development of the GSSC before launch, and the operation of the GSSC after launch. The GSSC Manager is Jay Norris, who is responsible for the GSSC budget and personnel, and for the day-to-day running of the GSSC. The GSSC Manager establishes the policies governing the development and operation of the GSSC. The GSSC's requirements are stated in the "GSSC Functional Requirements Document." The GSSC staff has organized itself internally to satisfy these requirements.

The GSSC staff consists of scientists and software developers who work closely in defining, implementing, delivering, maintaining and operating all aspects of the GSSC. The GSSC is divided into three 'domains.' Dave Davis is responsible for the science tools and databases. Robin Corbet is responsible for GSSC scheduling and planning: the development of the science timeline and the analysis of the impact of instrument commands on this timeline. David Band is responsible user services, which includes developing and maintaining the GSSC website, and running the guest investigator program.

The GSSC is physically located at GSFC. It is a mission-specific constituent of the Office of Guest Investigator Programs (OGIP) at the Laboratory for High Energy Astrophysics (LHEA). Both to assist the instrument operations center (IOCs) and to act as liaisons between the IOCs and the GSSC, the GSSC has stationed scientists at each of the IOCs: Jim Chiang at the LAT's IOC, the Instrument and Science Operations Center (ISOC), and Valerie Connaughton at the GBM IOC (GIOC).

2.3 GLAST Ground Elements That Interact with the GSSC

The GSSC interacts primarily with the Mission Operations Center (MOC) and the IOCs of the two instruments. The data flow is described in the "Project Data Management Plan." The data products that will be exchanged among the GSSC and these three other ground elements, and the method of transferring these data among the ground elements, will be described in two ICDs: an "Operations Data Products ICD" and a "Science Data Products ICD." The "Mission Operations Concept Document" is a high level overview of these interactions while the "Operations Agreement" will describe in detail the interactions between the ground elements. Figure 2-2 presents the Ground System elements relevant to the GSSC.

2.3.1 Mission Operations Center

The GLAST Mission Operations Center (MOC) is located at GSFC, and is modeled on the Swift MOC. Goldbelt Orca/Omitron is the contractor responsible for the design, implementation, testing, documentation, and delivery of the MOC systems, and will also

provide the Flight Operations Team (FOT) to support all pre-launch, launch, early orbit, and normal operations. The observatory will be commanded by the MOC; the MOC will construct the mission timeline using the science timeline provided by the GSSC. All data from the observatory will be sent to the MOC, which will then distribute them to the GSSC and the IOCs after performing Level 0 processing (time-ordering packets, removing duplicate packets, and tracking packet accounting information).

2.3.2 Instrument Science and Operations Center (ISOC)

The ISOC is a component of the LAT instrument team, and is located at the Stanford Linear Accelerator Center (SLAC) near Palo Alto, CA. The ISOC may consist of a number of internal components responsible for different aspects of the ISOC's operations. The ISOC and the LAT instrument team are responsible for providing the GSSC with instrument response functions that characterize the LAT instrument and analysis software that will enable the scientific community to analyze the LAT photon lists. These response functions will be updated by the ISOC based on in-flight experience. During the mission the ISOC will perform Level 1 processing, which results in the photon lists that the scientific community will analyze. Searching the data for transients is part of the Level 1 processing. The ISOC will monitor the LAT's performance from the housekeeping data, and will control the LAT's operations. Commands for the LAT will originate in the ISOC, and will be sent to the MOC through the GSSC; the GSSC will evaluate the impact on the science timeline.

The ISOC will also be responsible for supporting the LAT team's scientific investigations. This will include providing data to team members. This functionality is beyond the scope of this document.

2.3.3 GBM IOC (GIOC)

The GIOC is a component of the GBM instrument team, and is located at the National Space Science and Technology Center (NSSTC) in Huntsville, AL. The GIOC will provide the GSSC with detector response matrices that characterize the GBM detectors and analysis software that will enable the scientific community to analyze the GBM burst data. During the mission the GIOC will calibrate the GBM data as part of their Level 1 processing. The GIOC will monitor the GBM's performance from the housekeeping data, and will control the GBM's operations. Commands for the GBM will originate in the GIOC, and will be sent to the MOC through the GSSC; the GSSC will evaluate the impact on the science timeline.

2.3.4 High Energy Astrophysics Science Archive Research Center (HEASARC)

The HEASARC, located in LHEA at GSFC, will be the permanent archive for GLAST data products, calibration data and documentation. The HEASARC maintains software and database standards to which the GSSC will adhere; these standards are

being extended to accommodate the needs of the GLAST data. The GSSC computer system will be a subset of the HEASARC system, and will participate in the HEASARC's computer security protocols. The relationship between the HEASARC and the GSSC is governed by the "HEASARC-GSSC Memorandum of Understanding." The HEASARC has appointed Mike Corcoran as its liaison to the GSSC.

2.3.5 GRB Coordinates Network (GCN)

Maintained within LHEA at GSFC, the GRB Coordinates Network (GCN) distributes burst locations and other burst-related information to the gamma-ray burst community. The GCN is an existing service with well-established protocols. All missions that detect bursts may disseminate through the GCN fixed-format Notices providing the time of the burst or an estimate of its position. Similarly, observers of bursts or their afterglows can distribute Circulars through the GCN describing their observations.

Burst alerts from both the GBM and the LAT will be formatted into GCN Notices and submitted to the GCN by the Burst Alert Processor (BAP), a computer that will be developed by the GIOC, maintained by the GSSC, and located at GSFC. The BAP will also calculate (without human intervention) improved burst locations based on the GBM data downlinked in the Burst Telemetry; these improved locations will also be disseminated as GCN Notices. A similar capability to calculate improved burst locations based on LAT data may be created. Finally, both IOCs may calculate and distribute as GCN Notices improved positions with human intervention based on both the burst telemetry and the regularly-downlinked data. Other information (e.g., fluences, durations, spectral parameters) may be publicized as GCN Circulars.

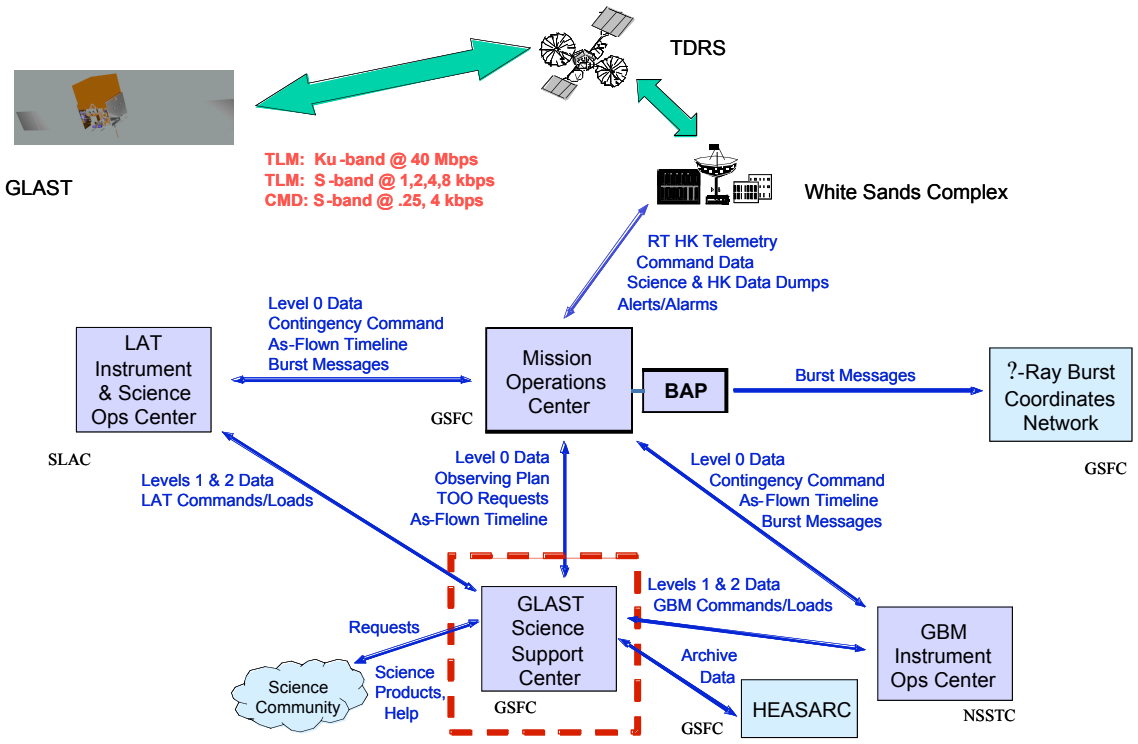

Figure 2-2: Ground System relevant to GSSC.

3 Development Methodology

The approach for development of the GSSC is portrayed in the sections below, which describe requirements analysis, system design, interface definition, software development, testing, delivery, documentation, and configuration management.

3.1 Requirements Analysis

The "GSSC Functional Requirements Document" formally traces to the "Ground System Requirements Document," the "Mission System Specification," and the "Science Requirements Document." Note that some of the GSSC's non-operations requirements do not trace through the "Ground System Requirements Document." The detailed element-level requirements were derived with guidance from other documents such as the "GLAST Announcement of Opportunity," the "Project Data Management Plan" and the "Mission Operations Concept Document."

The GSSC staff keeps track of policy directives and changes to the GLAST documents that affect the GSSC. They participate in the Science Working Group meetings that establish science policy, and in various formal and informal meetings where the interfaces with the other ground elements are defined (see §3.3). GSSC staff members have participated in both the instrument development and operations of a large number of previous astrophysics missions, including GLAST's predecessor, the *Compton Gamma Ray Observatory*. The understanding of the status of the GLAST mission and its scientific objectives, and the experience of the GSSC staff guide the derivation and refinement of the GSSC's requirements.

Verification of compliance with the requirements is tracked through the "GSSC Verification Matrix" using methods specified in the "Mission System Specification." The "GSSC Verification Matrix" is maintained within the GSSC Configuration Management (CM) system, and thus requirement compliance is noted on the "GSSC Verification Matrix" by the GSSC Configuration Control Board (CCB).

3.2 System Design

The design of the GSSC is described in the "GSSC Design Document" that addresses:

- Hardware architecture—The servers used to provide data, software and documentation to the scientific community; the networks that deliver data to the GSSC and through which commands and notices will flow between the GSSC and the other ground elements; and the servers on which the GSSC will develop and maintain software.

- Software architecture—The analysis software that the GSSC will provide the scientific community has been defined jointly by the GSSC and the IOCs, is being developed under the IOCs' management, and is described by other documents. Consequently the "GSSC Design Document" will provide an overview of only the GSSC-specific tools. Described in detail in the "GSSC Design Document" are the software processes and internal interfaces necessary for:
    - Ingesting data from the other ground elements, populating the GSSC databases and providing the scientific community with these data
    - Ingesting instrument commands from the IOCs, evaluating the commands for their impact on the science timeline, and transmitting the commands to the MOC
    - Issuing target of opportunity (TOO) orders
    - Creating the science timeline
    - Performing the GSSC's Level 2 processing

3.3 Interface Definition

The interfaces between the GSSC and the other ground elements (the MOC, the ISOC, the GIOC and the HEASARC) will be defined in ICDs and operations agreements. The ICDs will describe the content and format of the data that will flow between the GSSC, the IOCs and the MOC, and the protocols governing these flows. The "Science Data Products ICD" will be developed and controlled by the GSSC, while the "Operations Data Products ICD" will be developed and controlled by the MOC. The procedures governing the data transfers will be described in operations agreements.

The interfaces between the GSSC and other ground elements are developed and evaluated by formal and informal exchanges between the staffs of the different ground elements. These include weekly GLAST Operations Working Group (GOWG) meetings and periodic Technical Interface Meetings (TIMs). Document development and review preparation initiate many interface agreements.

3.4 Software Development

The LAT science analysis tools are the most sophisticated software with which the GSSC is involved. The LAT burst analysis tools will also analyze GBM burst data, and only two GBM-specific tools need be developed. The development of the LAT tools is the responsibility of the ISOC, although the GSSC participated in the definition of the suite of tools, and is contributing resources towards their development. The suite of LAT science analysis tools has been defined in a document that was reviewed by a panel of scientists; this document is being converted into a software requirements document. Here, the development methodology is only described briefly. The tools are being developed as FTOOLS, the analysis paradigm maintained by the HEASARC. Since the GLAST analysis software will be among the first FTOOLS written in C++ and will be

supported on both Windows and UNIX platforms, the software libraries used by FTOOLS are being extended for C++ and being ported to the Windows operating system. The LAT science analysis tools are developed with the LAT team's software development environment: CVS is used for code maintenance and configuration control; the code is 'built' using CMT; and documentation is prepared with Doxygen. Once code has reached a sufficient level of maturity, it is compiled and built every night, and if the build is successful, the executable is run on a standard test suite. The development of a particular tool is evaluated periodically by code walk-throughs by a panel of software developers who are not involved with that tool. Code is developed and tested on Windows and Linux platforms. Although the code will occasionally be ported to other platforms on which FTOOLS run to insure the code remains as platform-independent as possible, only at the end of the development process will a full port to all these platforms be completed.

The development of the GSSC-specific tools is described in the "GSSC Software Management Plan." There are four categories of GSSC-specific software: scheduling and planning software used to create the science timeline and vet the commands that pass through the GSSC for their impact on the science timeline; pipelines that ingest data from other ground elements and perform data analysis; web interface; and internal science software. The scheduling and planning software and pipelines will consist largely of COTS and GOTS with the addition of some PERL scripts. The internal science software will consist of variants of the science analysis tools and some simple additional tools. The development methodology described in the "GSSC Software Management Plan" will be a modified version of the methodology used for the LAT science tools. The differences are: a) the software need only run on Linux platforms and b) much of the software will be scripts or existing software.

The software that interfaces with other ground elements will be released on a schedule driven by the Ground Readiness Tests (GRTs) run by the Ground System and by the Data Challenges run by the LAT team. A summary of the release schedule is provided below, and will be updated as appropriate to reflect any schedule changes. The complete schedule is in the "GSSC Software Management Plan."

3.5 Testing

Since many of the GSSC's requirements are satisfied through software, verifying compliance of these requirements is achieved through testing. The GSSC's test plan will be described in the "GSSC Test Plan" document. Here we provide an overview.

The GSSC's components, whether hardware or software, will be tested hierarchically: smaller units will be tested independently. Larger units will be formed of these smaller units, and then these larger units will be tested. Components internal to the GSSC will be tested before their interfaces to other Ground System elements are tested.

The software requirements documents will specify test suites that the software must process correctly. These suites will include corrupted data that will test whether the software fails gracefully. Tests for an individual tool will be rerun periodically to ensure that small changes either in the code or in the computing environment have not introduced errors into the tool. Similarly, the tests will be rerun when tools are integrated together to ensure that the individual tool still runs proPerly.

The GSSC's interfaces with the other ground elements will be tested in a series of Ground Readiness Tests that will be run by the Ground System. Details on these tests will be provided by the "Ground System Test Plan." The following is a schedule of the GRTs and a description of the GSSC interface that will be tested.

- GRT1 (2/15/05): Ingest Level 0 housekeeping data from MOC
- GRT2 (4/15/05): Preliminary test of command and activity schedule flows to and from other Ground System components
- GRT3 (6/15/05): Additional tests of command and activity schedule flows to and from other Ground System components
- GRT4 (9/1/05): Regression testing
- GRT5 (11/15/05): Ingest Level 1 data from IOCs
- GRT6 (3/15/06): Operate backup Level 1 pipelines, TOO orders
- GRT7 (5/1/06): Regression testing

These interfaces will also be exercised in the End-to-End Tests (ETE):

- ETE1 (2/11/06):
- ETE2 (3/15/06):
- ETE3 (6/15/06):
- ETE4 (8/25/06):
- ETE5 (10/14/06):

The LAT science analysis software will be tested in a series of three Data Challenges run by the LAT team. The LAT team is responsible for managing the development of these tools; however, because the GSSC is heavily involved in the development, the data challenge schedule is presented here:

- Data Challenge 1 (9/03-3/04): Software of release 1
- Data Challenge 2 (2/05-5/05): Software of release 2
- Data Challenge 3 (2/06-9/06): Software of release 3

3.6 Documents

The GSSC's concepts, requirements, design and operations will be described in a series of documents that may be specific to the GSSC, or may be part of a Ground System or Project-level document. All these documents are under configuration management (CM) at a particular level.

The following are GSSC-specific documents, along with the level which provides configuration management. Note that these documents address both the organization and its software, and thus the content is sometimes found in multiple documents.

Name	Content	Identifier	CM
GSSC Functional Requirements Document	Element level requirements	433-RQMT-0002	Project
GSSC Development Plan (this document)	Plan for developing the GSSC	GSSC-0001	Internal
GSSC Verification Matrix	Matrix of requirements extracted from the Functional Requirements Document on which requirement compliance is recorded	GSSC-0002	Internal
GSSC Design Document	Design of GSSC and its systems	GSSC-0003	Internal
GSSC Software Management Plan	Plan for developing and managing the GSSC's software	GSSC-0004	Internal
GSSC Test Plan	Plan for verifying GSSC compliance with its requirements, particularly regarding software	GSSC-0005	Internal
LAT Event Summary Database Requirements	Requirements for the LAT Event and Photon Databases	GSSC-0006	Internal
Standard Analysis Environment Database Requirements	Requirements for Standard Analysis Environment databases other than event and photon databases.	GSSC-0007	Internal
GSSC Operations Manual	The procedures for operating the GSSC after launch	GSSC-0008	Internal

A Project-level document, the "Project Data Management Plan (PDMP)" describes the role of the GSSC in the management of data within the Project. David Band has been assigned the responsibility for developing and maintaining the PDMP.

3.7 Configuration Management

The documents, ICDs, agreements and similar texts governing the GSSC, its operations and its interactions with other ground elements will be maintained under configuration management (CM) at the appropriate level: documents affecting the

Project as a whole (e.g., the Ground System Requirements Document) are under CM at the Project level; ICDs and agreements defining the interfaces between the GSSC and the ground elements are under CM at the Ground System level; and documents dealing with the internal workings of the GSSC are under CM within the GSSC. The "GSSC Functional Requirements Document" is the exception in that it was placed under CM at the Project level early in the development of the Ground System.

The Project level and Ground System level CM processes are described in other documents; documents at these levels for which the GSSC is responsible will be submitted to the appropriate Configuration Control Board (CCB) for baselining or revision. At the GSSC level, documents will be maintained within the GSSC CVS depository, and controlled by a CCB consisting of GSSC staff. GSSC level documents will be signed by the GSSC staff member preparing the document (under "Prepared by"), the GSSC Manager (under "Approved by"), and the Ground System/Operations Manager (under "Concurrence").

4 Management Plan

4.1 Schedules

The GSSC maintains a detailed development schedule for GSSC hardware, software and operations preparations. The schedule is driven by major system tests such as the Data Challenges for science software, and the Ground Readiness Tests (GRTs) and End-to-End (ETE) tests for operations.

4.2 Communications and Status Reporting

The GSSC staff at GSFC meets weekly to discuss the development of the GSSC. The meeting topic is announced in advance, and those staff members uninvolved in that topic need not attend. Staff members also schedule many ad hoc meetings. A password-protected internal website provides a forum for GSSC staff to share documents within the GSSC, while the GSSC shares documents with the rest of the GLAST mission through an open website that is not linked to the public GSSC website.

The GSSC provides the Ground System/Operations Manager (GSOM) with a weekly report of the GSSC's activities. These reports are collated by the GSSC Manager from reports by individual GSSC staff members, thereby providing GSSC leadership with additional information about activities within the GSSC. The GSOM incorporates salient points from the GSSC report into the weekly Ground System Report submitted to the project.

The GSSC participates in the Project Manager's monthly Project Status Reports. The GSSC reports at the periodic Science Working Group and Users' Committee meetings. Members of the GSSC staff also attend LAT collaboration meetings.

Members of the GSSC participate in weekly GLAST Operations Working Group (GOWG) meetings where progress and concerns are expressed to the GSOM and the Ground System team. The GOWG is the primary forum for coordinating the development of the Ground System. Members of the GSSC staff attend, and sometimes serve on the review panels for, reviews of other Ground System elements.

GSSC staff participates in a number of regular and semi-regular telecons and web-conferences. Some of these conferences involve chartered working groups, such as the GSSC-LAT Software Working Group.

4.3 Reviews

The GSSC's plans, designs and preparations for operations will be reviewed in the context of the Ground System's reviews. These include:

- Ground System Requirements Review (held July 22, 2003)—This review provided the driving requirements for the Ground System and the operational design within which these requirements were derived.

- Ground System Design Review (scheduled for August 18-19, 2004)—This review will demonstrate that the requirements, interfaces and design are of sufficient maturity to begin Ground System development.

- Mission Operations Review (scheduled for October, 2005)—This review will describe the schedule and approach for achieving operational readiness.

- Operational Readiness Review (scheduled for December, 2006)—This review will present the launch readiness of the Ground System.

In addition the GSSC will hold two element-specific peer reviews. These reviews function as less-formal Preliminary and Comprehensive Design Reviews, and thus focus on: a) requirements; b) organization; c) hardware and software design and schedule; d) definition of internal and external interfaces; and e) the mapping of the requirements into the GSSC design. The first review was held on November 24, 2003, and the second will be held on July 13, 2004.

"Requests for Action" (RFAs) are issued by the reviewers and other interested parties at these Ground System and GSSC-specific reviews. These are Ground System RFAs that are tracked by the Ground System, although of course the GSSC also tracks its RFAs internally. The GSSC assigns staff members to address specific RFAs. The assigned staff members discuss the responses with the RFA originators; however, ultimately the RFAs are closed with the approval of the GSOM.

The GSSC's plans to support the scientific community will be presented to the GLAST Users' Committee. The analysis software that the GSSC will provide scientific investigators is being defined by the GSSC and the instrument teams jointly, and will be reviewed separately.

The GSSC will support all other mission-related reviews as requested.

4.4 ITAR/EAR

There are two categories of GSSC data that must be dealt with differently from the perspective of International Trade in Arms Regulations (ITAR) and Export

Administration Regulations (EAR): 1) GSSC designs and 2) the scientific data and software that the GSSC will provide the scientific community.

Because the GSSC will pass commands and construct scientific timelines, both of which involve spacecraft commands and capabilities, the GSSC designs clearly raise ITAR/EAR concerns. Since these are issues that concern the Ground System as a whole, we will implement the policies that the Ground System adopts. Specifically, websites throughout the Ground System that provide design information will be password-controlled, with access limited to the appropriate audience.

The ITAR/EAR issues that the GSSC faces in serving the scientific community with data and analysis software are the same as those that similar organizations of other missions must deal with. Since the GSSC is a constituent of OGIP, we plan to implement the ITAR/EAR policies that will apply to the OGIP. Specifically, the LHEA chief will certify that scientific data are being released, and that it is impossible to replicate the spacecraft from the released data.

4.5 Release Schedules

4.5.1 GSSC Software

Details of the contents of each release are provided by the GSSC Software Management Plan.

- Release 1 (11/15/04), tied to GRT1 (2/15/05)—Level 0 file transfers from the MOC

Release 2 (2/1/05), tied to GRT2 (4/15/05)—Commands from IOCs, timelines to the MOC, Project Database from the MOC

Release 3 (5/1/05), tied to GRT3 (6/15/05)—BAP operations, scheduling tool, ingest of scheduling data

- Release 4 (8/1/05), tied to GRT4 (9/1/05) and GRT5 (11/15/05)—Operations planning tools, ingest tools for Level 1 and 2 data

- Release 5 (1/31/06), tied to GRT6 (3/15/06)—Backup pipelines, TOO tool

- Release 6 (4/3/06), tied to GRT7 (5/15/06) and first NASA Research Announcement (NRA) release—Ingest tools for notifications, SAA updates, pulsar ephemerides, GI support tools required for the NRA

- Release 7 (1/15/07), tied to launch—Cleanup, complete website

4.5.2 Computer System

Phase 1 (3/1/04)—Single processor system tied to Beowulf database system

Phase 2 (1/15/05)—Preliminary multiprocessor system

Phase 3 (3/1/06)—Complete multiprocessor system

4.5.3 LAT Science Analysis Tools

Management of the development of the LAT science analysis tools is the responsibility of the ISOC. Since the GSSC is involved heavily in this development, the release schedule is presented here

Release 1 (12/15/03)—Prototypes of basic tools: data extraction from databases, likelihood tool, basic burst tools

Release 2 (3/05)—Completion of basic tools. Prototypes of advanced tools: pulsar tools, graphic displays

Release 3 (3/06)—Completion of all tools

5 Maintenance Plan

The GSSC team is responsible for the maintenance of the GSSC for the life of the GLAST mission and for the period after the mission's termination necessary to complete archiving and documenting all the mission's data products. Consequently, the GSSC will retain a staff of scientists and programmers for this purpose. All software developed or modified by the GSSC will be maintained by GSSC programmers. This software maintenance will include new releases that will fix bugs, improve system performance based on operating experience, and enhance the scientific return.

6 Mission Criticality

The GSSC's only mission-critical function is the passing of commands from the IOCs to the MOC. Permanent damage can result if the GSSC fails to pass an urgent command necessary to mitigate an instrument-threatening condition, or if the GSSC garbles a command. The GSSC's design of the command passing function will address the potential damage inherent in handling instrument commands: the GSSC will not modify the commands it receives from the IOCs; the IOCs will be able to bypass the GSSC if necessary; and the IOCs will be notified if and when the GSSC has passed a command to the MOC.

Since the science timeline the GSSC will prepare is incorporated into the mission timeline by the MOC, and the MOC will check that the timeline does not violate any constraints, the GSSC's role in mission planning is not considered mission-critical.

While the GSSC has few mission-critical functions, as the interface between the mission and the user community the GSSC is critical to the mission's ultimate scientific success. If the users cannot extract data or do not have tools that are easy to use and well-documented, the GLAST data will not be analyzed properly and rapidly. Timely analysis of GLAST data is necessary to trigger the multiwavelength observations that will be necessary to provide the context for the GLAST observations. Since developing the analysis tools is the responsibility of the instrument teams, the GSSC has become involved in this development to provide the perspective of the user community. The software development plan emphasizes basic functionality, such as database access, early in the schedule. This basic functionality will be tested early in the Data Challenges and Ground System tests. The GSSC has begun reporting to a Users' Committee much earlier than is typical.

The GSSC will use the Ground System's risk assessment and mitigation system.

7/8/2004

ACRONYM LIST

BAP	Burst Alert Processor
CCB	Configuration Control Board
COTS	Commercial Off-The-Shelf
CM	Configuration Management
EAR	Export Administration Regulations
ETE	End-to-End
FOT	Flight Operations Team
GBM	GLAST Burst Monitor
GCN	Gamma-ray burst Coordinates Network
GIOC	GBM IOC
GLAST	Gamma-Ray Large Area Space Telescope
GOTS	Government Off-The-Shelf
GOWG	GLAST Operations Working Group
GRT	Ground Readiness Test
GSFC	Goddard Space Flight Center
GSOM	Ground System/Operations Manager
GSSC	GLAST Science Support Center
HEASARC	High Energy Astrophysics Science Archive Research Center
IOC	Instrument Operations Center
ISOC	Instrument Science and Operations Center
ITAR	International Trade in Arms Regulations
LAT	Large Area Telescope
LHEA	Laboratory for High Energy Astrophysics
MOC	Mission Operations Center
NSSTC	National Space Science and Technology Center
OGIP	Office of Guest Investigator Programs
PDMP	Project Data Management Plan
SLAC	Stanford Linear Accelerator Center
TIM	Technical Exchange Meeting
TOO	Target Of Opportunity